

Remarks

Claims 1-22 are pending in the subject application. Applicants acknowledge that claims 10-22 have been withdrawn from further consideration as being drawn to a non-elected invention or non-elected species. However, Applicants wish to reserve the right to request rejoinder of the non-elected method claims upon an indication of an allowable claim in accordance with MPEP §821.04. By this Amendment, Applicants have amended claims 1-14 and 20-22. Support for the amended claims can be found throughout the subject specification including, for example, page 10, line 17; page 16, line 23; page 18, line 16; and page 19, line 19. Upon entry of the above amendments, claims 1-9 will be before the Examiner.

Claims 1-9 are rejected under 35 USC §103(a) as obvious over Guo *et al.* (1995) in view of Wang *et al.* (1997), Snyder (1979), and Zhang *et al.* (1995). Claims 3-9 are rejected under 35 USC §103(a) as obvious over Guo *et al.* (1995) in view of Wang *et al.* (1997), Snyder (1979), and Zhang *et al.* (1995) and further in view of Frechet *et al.* (U.S. Patent No. 5,431,807).

Applicants submit that the cited references are not properly combinable because there is no suggestion or modification to combine teachings of these various separation technologies. The Federal Circuit has set forth some guidelines on the appropriateness of combining references under a 35 U.S.C. §103(a) rejection and has stated “[t]here must be some reason, suggestion, or motivation found in the prior art whereby a person of ordinary skill in the field of the invention would make the combination.” *In re Octiker*, 977 F.2d 1443, 1447 (Fed. Cir. 1992). Although the Guo *et al.* reference refers to a capillary electrochromatography column, Applicants respectfully point out that the remaining references relate to distinct branches of separation technologies.

Specifically, the Zhang *et al.* reference provides guidance on different ways to achieve selectivity in reversed phase liquid chromatography and micellar liquid chromatography. The Frechet patent is directed to high performance liquid chromatography (HPLC) columns. The Snyder text also pertains to HPLC. Finally, the Wang *et al.* reference discusses preparation for gas chromatography columns.

Applicants have submitted herewith a Declaration, including an Exhibit A, under 37 CFR 1.132 establishing that the skilled artisan would lack motivation to combine the above-mentioned references because the separation technologies cited by the secondary references (Wang *et al.*,

Snyder, Zhang *et al.*, and Frechet) pertain to uniquely different separation technologies than the separation technology utilized in the claimed CEC columns. Specifically, the Zhang *et al.* reference provides guidance on different ways to achieve selectivity in reversed phase liquid chromatography and micellar liquid chromatography. The Frechet patent is directed to high performance liquid chromatography (HPLC) columns. The Snyder text also pertains to HPLC. Finally, the Wang *et al.* reference discusses preparations for gas chromatography columns.

The Guo *et al.* article fails to teach or suggest the elected species and elected invention of the subject invention because Guo *et al.* fails to teach a positively charged and deactivated sol-gel coating. Additionally, the Guo *et al.* column lacks a mechanism wherein the magnitude of electroosmotic flow (EOF) across a range of pHs is controlled. The Guo *et al.* article fails to teach or suggest how to deactivate an OT CEC column without a concomitant reduction of EOF. Silanol groups play two different roles: one beneficial and the other deleterious for CEC separation. First, through dissociation, silanol groups provide the negative surface charge essential for the generation of EOF, and therefore, mobile phase flow through the CEC column. This is beneficial since EOF is a prerequisite for CEC operation. Second, in spite of their beneficial role in generating EOF, silanol groups also represent the adsorptive sites in the column and are responsible for deleterious effects like peak tailing, sample loss, poor sample recovery, etc. Deactivation of the column through chemical derivatization of the silanol groups would reduce these deleterious effects; however, this would also lead to a drastic reduction in EOF making the mobile phase flow through the column impractically slow. This would translate into a drastic increase in analysis time. Therefore, an artisan with average skill in CEC would not be motivated to deactivate an OT-CEC column described by Guo *et al.* to arrive at the claimed invention.

Furthermore, the available surface charge (and hence EOF) for the Guo *et al.* CEC column is dependent on the pH of the mobile phase. Therefore, even the undeactivated Guo *et al.* CEC column would provide practicable EOF only above certain pH value. Silanol groups are slightly acidic ( $pK_a \approx 7.5$ ). Therefore, use of a mobile phase more acidic than silanol groups would lead to protonation of the dissociated silanols and a concomitant decrease in surface charge, and hence, the decrease of the EOF and mobile phase flow through the column. The surface charge (and hence EOF) would become practically zero at the isoelectric point of silica ( $pH \sim 2$ ) rendering Guo column useless for

CEC operation under highly acidic conditions. The purpose of the sol-gel precursors in the claimed invention is to both control the direction of electroosmotic flow and to deactivate any surface silanol groups. Thus, Guo *et al.* alone fails to teach or suggest the open tubular CEC columns of the subject invention.

The deficiencies in Guo *et al.* would not be remedied by the teachings of the Zhang *et al.* article because the skilled artisan would lack sufficient motivation to combine them. The teachings of the Zhang *et al.* reference apply to reversed-phase liquid chromatography and micellar liquid chromatography where mobile phase flow is generated by a mechanical pump – not via EOF. Zhang teaches how ionic interactions can be utilized in HPLC to enhance separation selectivity but fails to teach the possibility of using cationic surfactants in a sol-gel coating for use in a CEC column to control EOF. Zhang's teaching is confined to HPLC and is not directly applicable to CEC. The skilled artisan would not apply the teachings for an HPLC column to a CEC column. Zhang's teaching does not include a mechanism for column deactivation, and the skilled artisan would not expect efficient separation to take place in a column without deactivation. Furthermore, although Zhang *et al.* does discuss a positive charge in the stationary phase, this positive charge relates to the chromatographic selectivity; Zhang *et al.* fails to teach or suggest a positively charged sol-gel stationary phase or coating to affect the direction of the mobile phase flow. It fails to teach that this positive charge reverses the direction of the mobile phase flow. Zhang's teaching belongs to HPLC packed columns and modifying Guo by combining Zhang would result in a column that is no longer open tubular. The use of such packed columns in CEC would result in operational difficulties including the need for end-frits to retain the particles, disruption of operation due to bubble formation, etc. Since the column is not deactivated, solute adsorption would be another problem, especially for polar analytes. Because of these difficulties, the skilled artisan would not be motivated to apply Zhang's teaching about HPLC packed columns to a CEC column.

Snyder also fails to remedy the failings of the Guo *et al.* column. As noted above, the Snyder text refers to HPLC packings. The skilled artisan would not combine the teachings from a reference discussing HPLC because voltage is not applied to an HPLC column to induce mobile phase flow. Also, modifying Guo by combining Snyder would result in a column that is no longer open tubular. As discussed on page 3, lines 4-17 of the instant application, incorporating packings into CEC

columns results in technical difficulties like bubble formation and requires the addition of retaining end frits. Thus, the skilled artisan would not be motivated to modify Guo's open tubular column to packed configuration because the modified column would require additional processing equipment (e.g., the packing and the frit) and lead to increased technical difficulties. Also, the packings referenced in Snyder would be rendered electrically neutral at low pHs, especially at the isoelectric point of silica (pH ~ 2). A column with such an electrically neutral surface would be rendered inoperative in CEC because CEC requires EOF for mobile phase flow. EOF cannot be generated by applying voltage if the surface is electrically neutral.. Additionally, Snyder does not recognize that the deactivation of packed particles through chemical derivatization would lead an impracticably slow EOF because of the reduction of surface charge. Thus, modifying the teachings of Guo *et al.* with Snyder would result in an inoperative column with increased technical requirements, and the skilled artisan would not be motivated to perform such a combination.

Moreover, the skilled artisan would lack motivation to combine the teachings of the Wang *et al.* article with the teachings of the Guo *et al.* article because the skilled artisan would not expect the desired separation to take place. Furthermore, the Declarant is an author of the Wang *et al.* article and a co-inventor of the claimed technology. Although Wang *et al.* does provide a process to prepare sol-gel capillary columns, these teachings are limited to gas chromatographic (GC) columns, which operate using gaseous mobile phases as opposed to liquid mobile phases in CEC. In GC, the gaseous mobile phase plays no role (except for carrying the sample) in separation while in CEC the liquid mobile phase actively participate in the separation process by providing molecular level interactions with the solute molecules. In a GC column, the samples are transported by a flow of a pressurized inert gas used as the mobile phase, and not electroosmotic flow. The coating in the Wang *et al.* column is highly deactivated due to the derivatization of the silanol groups via two different mechanisms. This is evidenced by the highly symmetrical GC peaks for polar analytes obtained on Wang column. Because of extensive column deactivation, silanol group concentration (and hence surface charge obtained from the dissociation of silanol groups) in the Wang *et al.* column would be extremely low. If the coating from Wang *et al.*'s GC column were applied to Guo's column and voltage applied, the skilled artisan would expect impracticably slow electroosmotic flow

through the column, and such columns would be rendered inoperable in CEC. Therefore, a skilled artisan would not be motivated to apply the Wang coatings to the Guo column to perform CEC.

Additionally, the skilled artisan would not combine the teachings of Wang *et al.* and Guo *et al.* because the Wang *et al.* article teaches that deactivation is critical for GC separation of polar compounds. Wang *et al.* fails to suggest that this is a critical step for capillary electrochromatography. Furthermore, the reagents useful to deactivate silanol groups in the sol-gel GC columns do not suggest or teach the reagents claimed in the subject invention.

The Frechet patent also fails to remedy the teachings of the Guo *et al.* columns as it relates to claims 3-9. Frechet provides teachings for packings for HPLC columns. Thus, it fails to suggest anything about charged sol-gel coatings. The packings in Frechet's packed columns are not deactivated. If the packings of the Frechet patent were applied to the Guo column, the skilled artisan would expect unsteady EOF, variation of EOF with pH, need for retaining end-frits in the column, reproducibility problems, unpredictable disruption of CEC run due to bubble formation in the column, and other, technical difficulties. As a result, the skilled artisan would not be motivated to combine these teachings.

Accordingly, reconsideration and withdrawal of the rejection under 35 USC §103(a) is respectfully requested.


It should be understood that the amendments presented herein have been made solely to expedite prosecution of the subject application to completion and should not be construed as an indication of Applicants' agreement with or acquiescence in the Examiner's position. Applicants expressly reserve the right to pursue the invention(s) disclosed in the subject application, including any subject matter canceled or not pursued during prosecution of the subject application, in a related application.

In view of the foregoing remarks and amendments to the claims, Applicants believe that the currently pending claims are in condition for allowance, and such action is respectfully requested.

The Commissioner is hereby authorized to charge any fees under 37 CFR §§1.16 or 1.17 as required by this paper to Deposit Account No. 19-0065.

Applicants invite the Examiner to call the undersigned if clarification is needed on any of this response, or if the Examiner believes a telephonic interview would expedite the prosecution of the subject application to completion.

Respectfully submitted,

  
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JMM/amh

Enclosures: Petition and Fee for Extension of Time Under 37 CFR 1.136(a)  
Declaration under 37 CFR 1.132 by Dr. Abdul Malik  
Exhibit A



Patent Application  
Docket No. USF-222XCT  
Serial No. 10/057,080

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Examiner : Ernest G. Therkorn  
Art Unit : 1723  
Applicants : Abdul Malik, James D. Hayes  
Serial No. : 10/057,080  
Filed : January 24, 2002  
Conf. No. : 3341  
For : Sol-gel Open Tubular ODS Columns With Charged Inner Surface for  
Capillary Electrochromatography

Mail Stop Amendment  
Commissioner for Patents  
P.O. Box 1450  
Alexandria, VA 22313-1450

DECLARATION OF ABDUL MALIK, Ph.D., UNDER 37 CFR 1.132

Sir:

I, ABDUL MALIK, hereby declare:

THAT, I am a co-inventor of the subject matter claimed in U.S. patent application Serial No. 10/057,080 (hereinafter the '080 application);

THAT, a copy of my curriculum vitae is attached hereto as Exhibit A;

THAT, I have reviewed the Office Action mailed February 2, 2005, in the '080 application along with the references cited therein;

THAT, by virtue of my employment, my educational background, my research, my participation in authoring and reviewing articles and publications, my attendance at and participation in conferences and seminars, and my personal correspondence with others in the field, I am aware of the level of skill of the ordinary artisan in the field of capillary electrochromatography.

And, being thus duly qualified, do further declare as follows:

I. The subject invention is based on open tubular capillary electrochromatographic (OT-CEC) columns. The subject invention's OT-CEC columns possess sol-gel coatings chemically bonded to the interior surface of the columns. The surface of the sol-gel coating can be positively charged via a charged moiety. The sol-gel coating also contains a chromatographic ligand and is deactivated to prevent silanol groups from undergoing adsorptive interactions with solute molecules; such interactions often lead to deleterious effects like peak tailing, poor sample recovery, irreversible sample loss, etc.

II. The Office Action states that the elected species and elected invention of the subject application are obvious over the teachings of the Guo *et al.* (*Anal. Chem.* **1995**, *67*, 2511-2515) in view of Wang *et al.* (*Anal. Chem.* **1997**, *69*, 4566-4576), Snyder (Introduction to Modern Liquid Chromatography, John Wiley & Sons, New York (1979), 278-80), and Zhang *et al.* (*Journal of Liquid Chromatography*, *18*(17) 2273-3396). Furthermore, the Office Action states that a subset of the elected species and elected invention as set forth in claims 3-9 are also obvious over the teachings of these same references combined with U.S. Patent No. 5,431,807 (the Frechet patent).

As a co-inventor and an expert in this field, the undersigned submits that the skilled artisan would lack motivation to combine the above-mentioned references because the separation technologies cited by the secondary references (Wang *et al.*, Snyder, Zhang *et al.*, and Frechet) pertain to uniquely different separation technologies than the separation technology utilized in the claimed CEC columns. Specifically, the Zhang *et al.* reference provides guidance on different ways to achieve selectivity in reversed phase liquid chromatography and micellar liquid chromatography. The Frechet patent is directed to high performance liquid chromatography (HPLC) columns. The Snyder text also pertains to HPLC. Finally, the Wang *et al.* reference discusses preparations for gas chromatography columns.

The Guo *et al.* article fails to teach or suggest the elected species and elected invention of the subject invention because Guo *et al.* fails to teach a positively charged and deactivated sol-gel coating. Additionally, the Guo *et al.* column lacks a mechanism wherein the magnitude of electroosmotic flow (EOF) across a range of pHs is controlled. The Guo *et al.* article fails to teach how to deactivate an OT-CEC column without a concomitant reduction of EOF. Silanol groups play two different roles: one beneficial and the other deleterious for CEC separation.



First, through dissociation silanol groups provide the negative surface charge essential for the generation of EOF, and therefore, mobile phase flow through the CEC column. This is beneficial since EOF is a prerequisite for CEC operation. Second, in spite of their beneficial role in generating EOF, silanol groups also represent the adsorptive sites in the column and are responsible for deleterious effects like peak tailing, sample loss, poor sample recovery, etc. Deactivation of the column through chemical derivatization of the silanol groups would reduce these deleterious effects; however, this would also lead to a drastic reduction in EOF making the mobile phase flow through the column impractically slow. This would translate into a drastic increase in analysis time. Therefore, an artisan with average skill in CEC would not be motivated to deactivate the OT-CEC column described by Guo. *et al.* Third, the available surface charge (and hence EOF) is dependent on pH of the mobile phase in the Guo *et al.* CEC column. Therefore, even the undeactivated Guo *et al.* CEC column would provide practicable EOF only above certain pH values. Silanol groups are slightly acidic ( $pK_a \approx 7.5$ ). Use of a mobile phase more acidic than silanol groups would lead to protonation of the dissociated silanols and a concomitant decrease in surface charge, and hence the EOF and mobile phase flow through the column. The surface charge (and hence EOF) would become practically zero at the isoelectric point of silica ( $pH \sim 2$ ) rendering the Guo *et al.* column useless for CEC operation under highly acidic conditions. The purpose of the sol-gel precursors in the claimed invention is to both control the direction of electroosmotic flow and to deactivate any surface silanol groups. Thus, Guo *et al.* alone fails to teach or suggest the open tubular CEC columns of the subject invention.

The deficiencies in Guo *et al.* would not be remedied by the teachings of the Zhang *et al.* article because the skilled artisan would lack sufficient motivation to combine them. The teachings of the Zhang *et al.* reference apply to reversed-phase liquid chromatography and micellar liquid chromatography where mobile phase flow is generated by a mechanical pump – not via EOF. Zhang *et al.* teaches how ionic interactions can be utilized in HPLC to enhance separation selectivity but fails to teach or suggest the possibility of using cationic surfactants in a sol-gel coating for use in a CEC column to control EOF. Zhang's teaching is confined to HPLC and is not directly applicable to CEC. The skilled artisan would not apply the teachings for an HPLC column to a CEC column. Zhang's teaching does not include a mechanism for column deactivation, and the skilled artisan would not expect efficient separation to take place in a column without deactivation. Furthermore, although Zhang *et al.* does discuss a positive charge

in the stationary phase, this positive charge relates to the chromatographic selectivity; Zhang *et al.* fails to teach or suggest a positively charged sol-gel stationary phase or coating to affect the direction of the mobile phase flow. It fails to teach or suggest that this positive charge reverses the direction of the mobile phase flow. Zhang's teaching belongs to HPLC packed columns and modifying Guo *et al.* by combining Zhang *et al.* would result in a column that is no longer open tubular. The use of such packed columns in CEC would result in operational difficulties including the need for end-frits to retain the particles, disruption of operation due to bubble formation, *etc.* Since the column is not deactivated, solute adsorption would be another problem, especially for polar analytes. Because of these difficulties, the skilled artisan would not be motivated to apply Zhang's teaching about HPLC packed columns to a open tubular CEC.

Snyder also fails to remedy the failings of the Guo *et al.* column. As noted above, the Snyder text refers to HPLC packings. The skilled artisan would not combine the teachings from a reference discussing HPLC because voltage is not applied to an HPLC column to induce mobile phase flow. Also, modifying Guo *et al.* by combining Snyder would result in a column that is no longer open tubular. As discussed on page 3, lines 4-17 of the instant application, incorporating packings into CEC columns results in technical difficulties like bubble formation and requires the addition of retaining end frits. Thus, the skilled artisan would not be motivated to modify Guo's open tubular column to packed configuration because the modified column would require additional processing equipment (*e.g.*, the packing and the frit) and lead to increased technical difficulties.

Also, the packings referenced in Snyder would be rendered electrically neutral at low pHs, especially at the isoelectric point of silica (pH ~ 2). A column with such an electrically neutral surface would be rendered inoperative in CEC because CEC requires EOF for mobile phase flow. EOF cannot be generated by applying voltage if the surface is electrically neutral. Additionally, Snyder does not recognize that the deactivation of packed particles through chemical derivatization would lead an impracticably slow EOF because of the reduction of surface charge. Thus, modifying the teachings of Guo *et al.* with Snyder would result in an inoperative column with increased technical requirements, and the skilled artisan would not be motivated to perform such a combination.

Moreover, the skilled artisan would lack motivation to combine the teachings of the Wang *et al.* article with the teachings of the Guo *et al.* article because the skilled artisan would

not expect the desired separation to take place. Furthermore, the undersigned is a co-author of the Wang *et al.* article. Although Wang *et al.* does provide a process to prepare sol-gel capillary columns, these teachings are limited to gas chromatographic (GC) columns, which operate using gaseous mobile phases as opposed to liquid mobile phases in CEC. In GC, the gaseous mobile phase plays no role (except for carrying the sample) in separation while in CEC the liquid mobile phase actively participate in the separation process by providing molecular level interactions with the solute molecules. In a GC column, the samples are transported by a flow of a pressurized inert gas used as the mobile phase, and not electroosmotic flow. The coating in the Wang *et al.* column is highly deactivated due to the derivatization of the silanol groups via two different mechanisms. This is evidenced by the highly symmetrical GC peaks for polar analytes obtained on the Wang *et al.* column (See Wang *et al.*; Figures 5-9). Because of extensive column deactivation, silanol group concentration (and hence surface charge obtained from the dissociation of silanol groups) in the Wang *et al.* column would be extremely low. If the coating from Wang *et al.*'s GC column were applied to Guo's column and voltage applied, the skilled artisan would expect impracticably slow electroosmotic flow through the column, and such columns would be rendered inoperable in CEC. Therefore, a skilled artisan will not be motivated to apply the Wang *et al.* coatings to the Guo *et al.* column to perform CEC.

Additionally, the skilled artisan would not combine the teachings of Wang *et al.* and Guo *et al.* because the Wang *et al.* article teaches that deactivation is critical for GC separation of polar compounds. Wang *et al.* fails to suggest that this is a critical step for capillary electrochromatography. Furthermore, the reagents useful to deactivate silanol groups in the sol-gel GC columns do not suggest or teach the reagents claimed in the subject invention.

The Frechet patent also fails to remedy the inefficiencies in the teachings of the Guo *et al.* columns as it relates to claims 3-9. Frechet provides teachings for packings for HPLC columns. Thus, it fails to suggest anything about charged sol-gel coatings. The packings in Frechet's packed columns are not deactivated. If the packings of the Frechet patent were applied to the Guo *et al.* column, the skilled artisan would expect unsteady EOF, variation of EOF with pH, need for retaining end-frits in the column, reproducibility problems, unpredictable disruption of CEC run due to bubble formation in the column, and other technical difficulties. As a result, the skilled artisan would not be motivated to combine these teachings.

The undersigned declare further that all statements made herein of his or her own

knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or of any patent issuing thereon.

Further declarant sayeth naught.

Signed:

Abdul Malik  
By: Abdul Malik

Date:

06/01/2005

Exhibit A: Curriculum Vitae of Dr. Abdul Malik

## **EXHIBIT A**

## BIOGRAPHICAL SKETCH

### Abdul MALIK, Ph.D.

Associate Professor, Department of Chemistry, University of South Florida,  
4202 E. Fowler Avenue, SCA 400, Tampa, FL 33620-5250.

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### Employment:

- Aug. '99- Present      **Associate Professor** of Chemistry, University of South Florida, Tampa, Florida, USA.
- Apr. 96-Present      **Coordinator**, Analytical Chemistry Division, Department of Chemistry, University of South Florida, Tampa, Florida, USA.
- Aug. '94-Aug. 99:      **Assistant Professor** of Chemistry, University of South Florida, Tampa, Florida, USA.
- Sep. '92-Jul. '94:      **Research Assistant Professor** of Chemistry, Brigham Young Univ., Provo, Utah, USA.
- Jan. '91-Aug. '92:      **Postdoctoral Research Associate**, Department of Chemistry, Brigham Young University, Provo, Utah, USA.
- Oct. '89-Dec. '90:      **Research Fellow (Japanese Ministry of Education)**, Toyohashi University of Technology, Toyohashi, Japan.

### Areas of Specialization

- Analytical Separations:**      High Resolution Gas Chromatography, High Performance Capillary Electrophoresis, Supercritical Fluid Chromatography, High Performance Liquid Chromatography, Biomedical and Environmental Applications of Chromatographic, Electrophoretic, and Hyphenated Techniques;
- Sample Preparation:**      Solid-Phase Microextraction (SPME), Capillary Microextraction (CME), Supercritical Fluid Extraction (SFE).

### Education:

Ph.D., Russian Academy of Sciences, Moscow, Russia, 1985.  
M.S., Peoples' Friendship University, Moscow, Russia, 1980.  
Pre-college education in Bangladesh.

**Scientific Recognition**

- **Guest Editor, *Journal of Chromatography A*, Vol. 1025, No. 1, 2004.**
- **General Chair, 5<sup>th</sup> International Symposium on Advances in Extraction Technologies (ExTech 2003), St. Pete Beach, Florida, USA, March 5-7, 2003.**
- **Outstanding Undergraduate Teaching Award, University of South Florida Chemistry Department, 2003.**
- Our pioneering research in the area of sol-gel column technology has **made the front covers of:**
  - (a) **Popular Analytical Chemistry Textbook** by Daniel C. Harris, (Ref. *Quantitative Chemical Analysis*, 6<sup>th</sup> edition, Freeman, New York, USA, 2002);
  - (b) *Analytical Chemistry* – **the premier journal** in the field of our research (Ref. *Anal. Chem.* 1997, 69, 4556-4566).
- Selected as the **Editorial Advisory Board Member** of an International Journal- *Journal of Microcolumn Separations* (2001).
- **Member of the Scientific Committee**, International Symposium on Advances in Extraction Technologies (ExTech) – an annual series symposium, since 2000.
- Recognized by **American Laboratory Magazine (July 2000, News Edition, Editor's page)** for our research on sol-gel monolithic column technology for capillary electrochromatography that was termed by the magazine "**Best of Both worlds.**"
- Received University Development Fund (UDF) Award (1999 & 2000), sponsored by **Dow Chemical Company.**
- **Recognized for the best teaching performance in 1999** among twenty-three full-time faculty members in the **USF chemistry department.**
- **Excellence in Teaching and Mentorship** at the Master's Level: Director of the USF Outstanding Master's Thesis (1998).
- USF College of Arts and Sciences **Faculty Development Award** (1997, 1998).
- University of South Florida **Faculty International Travel Grant Award** (1998).
- University of South Florida **Research and Creative Scholarship Award** (1995, 1997).
- USF College of Arts and Sciences **Faculty Development Award** (1997).

- Alternate winner of the **Presidential Young Faculty Award**, University of South Florida (1996).
- University of South Florida **Research and Creative Scholarship Award** (1995).
- **Japanese Ministry of Education Research Fellowship** (1989-1990).

**Professional Affiliations:**

- **Member of:** (1) American Chemical Society; (2) American Association for the Advancement of Science.
- **Member of the Editorial Advisory Board** of the International Journal: *Journal of Microcolumn Separations*
- **Scientific Reviewer:** Eleven International Journals.

**Publications:** Over **Eighty** papers published in **refereed international journals**

**Patents:** **Twelve** (in total):  
**Six Awarded** (Three US Patents, One Australian patent, and two (former) USSR Patents);  
**Eight U.S. Patent Applications Pending**

**Presentations at National and International Symposia:** Over **100**.

***General Chair:*** Fifth **International Symposium** on the Advances in Extraction Technologies (**ExTech 2003**, March 5-7, 2003, Tampa, Florida, USA).

***Session Chair:*** At **Four** International Symposia on chromatography held in USA, Italy, and China.

***Plenary Lectures:*** **Seven** (at five international Symposia on Chromatography held in USA, Japan, Italy, and China).

***Invited Lectures:*** **Thirty-five** (at National and International Symposia on Chromatography)

**Recent Publications:**

W. Li, D.P. Fries, **A. Malik**, Negatively Charged Sol-Gel Column with Stable Electroosmotic Flow for Online Preconcentration of Zwitterionic Biomolecules in Capillary Electromigration Separations, *J. Sep. Sci.* **2005**, accepted (04.26.2005).



P. Yang, R.J. Whelan, E.E. Jameson, J.H. Kurzer, C. Carter-Su, A. Kabir, **A. Malik**, R.T. Kennedy, Capillary Electrophoresis and Fluorescence Anisotropy for Quantitative Analysis of Rapid Peptide-Protein Interactions using JAK2 and SH2-B $\beta$  as a Model System, *Anal. Chem.* **2005**, 77(8), 2482-2489

K. Alhooshani, A. Kabir, **A. Malik**, "Sol-Gel Zirconia-based Hybrid Organic-Inorganic Stationary Phase for Capillary Microextraction in Hyphenation with Gas Chromatographic Analysis," *J. Chromatogr. A* **2005**, 1062, 1-14.

**A. Malik**, "Sample Preconcentration Tubes with Sol-gel Surface coatings and/or Sol-gel Monolithic Beds," **US Patent No. 6,783,680 B2** (Date of Patent August 31, **2004**).

**A. Malik**, D.-X. Wang, Solid-Phase Microextraction Fiber Structure and Method of Making, **US Patent No. 6759126**, issue date: July 6, **2004**.

T.-Y. Kim, Alhooshani, K.; Kabir, A.; D.P. Fries, **A. Malik**, "High pH-Resistant, surface-bonded Sol-Gel Titania Hybrid Organic-Inorganic Coating for Effective On-line Hyphenation of Capillary Microextraction (In-Tube SPME) with High-Performance Liquid Chromatography", *J. Chromatogr. A* **2004**, 1047(2), 165-174.

A. Kabir, C. Hamlet, **A. Malik**, "Parts per Quadrillion Level Ultra-trace Analysis of Polar and Nonpolar Compounds *via* Solventless Microextraction on Sol-Gel Polytetrahydrofuran Coated Capillaries and Gas Chromatography-Flame Ionization Detection", *J. Chromatogr. A* **2004**, 1047(1), 1-13.

W. Li, D.P. Fries, **A. Malik**, "Sol-Gel Stationary Phases for Capillary Electrochromatography," *J. Chromatogr. A* **2004**, 1044 (1-2), 23-52.

A. Kabir, C. Hamlet, K.S. Yoo, G.R. Newkome, and **A. Malik**, "Capillary Microextraction on Sol-Gel Dendrimer Coatings", *J. Chromatogr. A* **2004**, 1034(1-2), 1-11.

**A. Malik**, D.X. Wang, "Capillary Column and Method of Making," **Australian Patent #765881**, January 15, **2004**.

**A. Malik**, "Foreword", *J. Chromatogr. A* **2004**, 1025 (1), 1.

W. Li, D.P. Fries, A. Alli, **A. Malik**, "Positively Charged Sol-Gel Coatings for On-line Preconcentration of Amino Acids in Capillary Electrophoresis," *Anal. Chem.* **2004**, 76 (1), 218-227.

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